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PACIFIC ISLANDS FISHERIES SCIENCE CENTER

A Summary of the Pacific Islands Region Catch Share Workshop, Honolulu, Hawaii March 9-12, 2010

Keith R. Criddle
Minling Pan
Kelly Davidson

June 2011

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Administrative Report H-11-03

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Administrative Reports may be cited as follows:

Criddle, K. R., M. Pan, and K. Davidson.
2011. A Summary of the Pacific Islands Region Catch Share Workshop, Honolulu, Hawaii, March 9-12, 2010. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Pacific Islands Fish. Sci. Cent. Admin. Rep. H-11-03, 28 p. + Appendix.

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Pacific Islands Fisheries Science Center
Administrative Report H-11-03

A Summary of the Pacific Islands Region Catch Share Workshop, Honolulu, Hawaii March 9-12, 2010

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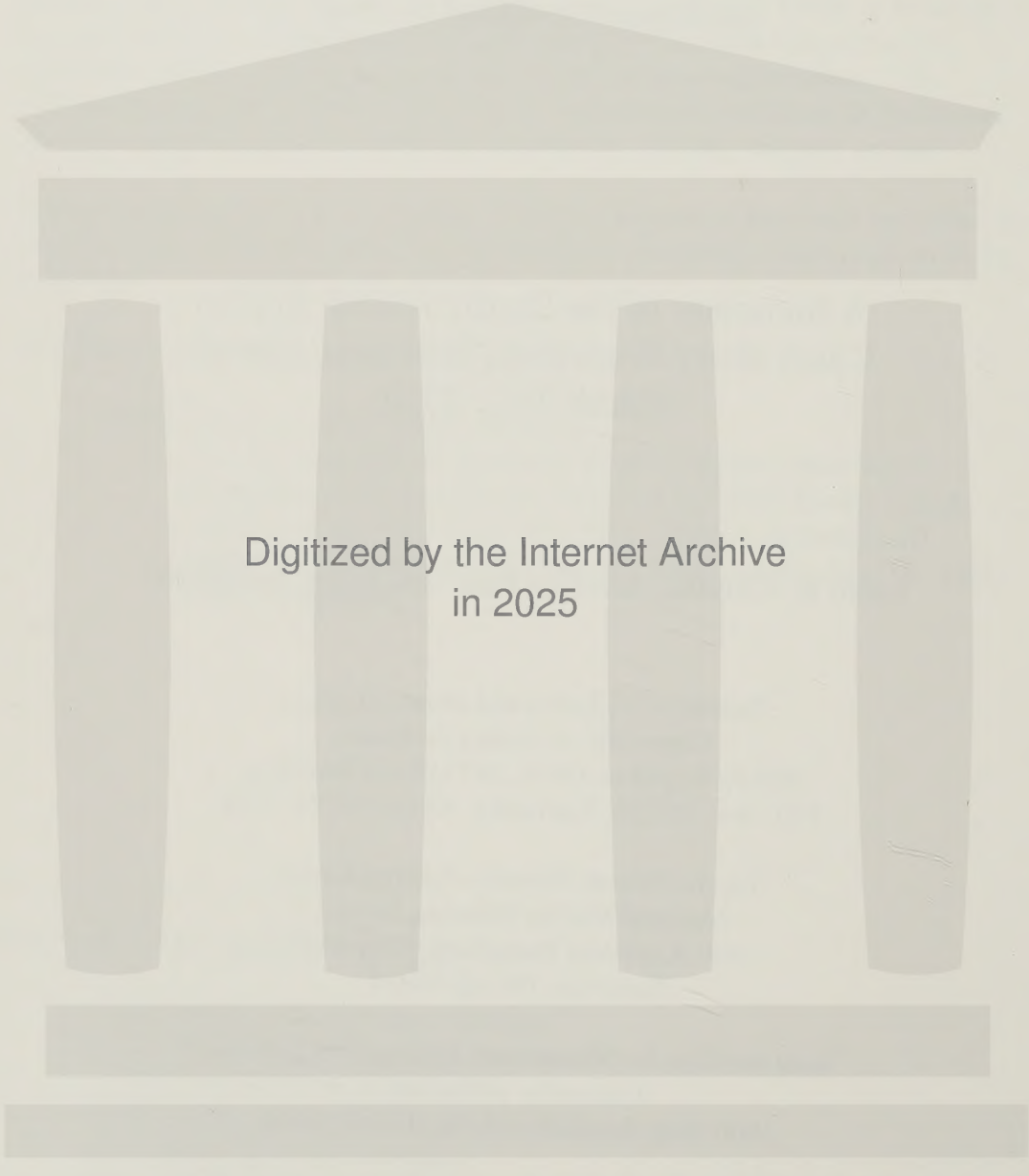
June 2011



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INTRODUCTION

The Pacific Islands Fisheries Science Center hosted a Catch Share Workshop at the East-West Center in Honolulu, Hawaii, during March 9–12, 2010. The workshop was held, in part, in response to NOAA's recent policy encouraging the use of catch shares as a fishery management tool to end overfishing and rebuild fisheries and fishing communities. To date, none of the fisheries in the Pacific Islands area operates under a catch share program. However, the Western Pacific Regional Fishery Management Council (WPRFMC) has listed six fisheries as potential candidates for catch share programs. These six fisheries are the Hawaii longline fishery, the American Samoa longline fishery, the Guam longline fishery, the Guam bottomfish fishery, the Hawaii Seamount pelagic fishery, and the main Hawaiian Islands bottomfish fishery.

The first day of the workshop consisted of presentations of case studies of existing catch share programs in the United States, Canada, and New Zealand. The cases were selected to highlight a wide range of variation in program objectives and design features and associated outcomes and effects. The second day of the workshop included an overview of Pacific Islands Region fisheries. These fisheries span the gamut from artisanal to industrial, single species to multispecies, demersal to pelagic, and nonmigratory to migratory. The featured fisheries were chosen to reflect the regional diversity of management objectives, diversity of life-history characteristics, heterogeneity among users, and diversity in assessment, monitoring, and enforcement capacity—some of these fisheries are closely monitored and carefully modeled; others lack reliable catch statistics and basic life-history information.

The creation of catch shares involves active and passive choices about the nature of entitlements and obligations (e.g., initial allocation mechanism/criteria, duration, transferability, divisibility, spatial dimension, individual vs. collective control of quota shares, single vs. multiple species, control in situ vs. ownership on capture) that attach to the quota shares. These choices take place against a backdrop of the life-history characteristics (e.g., growth rate, life expectancy, migratory behavior, interannual variability of stock levels and recruitment) of the species or collection of species for which the catch shares are defined as well as the backdrop of regulatory capacity and social norms.

The catch share case studies and introduction to Pacific Islands Region fisheries formed the basis for a 2-day structured discussion about the applicability, feasibility, and desirability of catch shares as an institutional structure for management of Pacific Islands Region fisheries. The discussion explored the relationship between catch share program design features and program performance relative to social, economic, and management objectives, as well as the interplay between program design features, life-history characteristics of target and incidental species, and assessment, monitoring, and enforcement capacity.

Overview of Report

This report has three primary sections:

- Summaries of the presentations on Day 1 regarding catch share programs in the United States, Canada, and New Zealand; and, on Day 2, regarding Introduction to Pacific Islands Region fisheries;
- A summary of the facilitated discussion that took place on Days 3-4 of the Workshop, organized by topic discussed; and
- Recommendations flowing from the discussion for catch share programs in general and creation of new Pacific Island catch share programs in particular.

A list of workshop participants and references cited appear at the end of the report.

CASE STUDIES OF CATCH SHARE PROGRAMS IN THE UNITED STATES, CANADA, AND NEW ZEALAND

Designing Dedicated Access Privileges: Should they be Place-based or Species-based?
James Wilen, University of California Davis

There are two primary ways to denominate dedicated access privileges: privileges to harvest specific quantities of individual species and privileges to all species and other ecosystem services in a discrete unit of space. Individual Transferable Quotas (ITQs), as conventionally operated, fail to account for certain residual inefficiencies: chiefly, spatial and within-season effort misallocation. Territorial Use Rights in Fisheries (TURFs) may, in principle, overcome some of these inefficiencies but with increased transaction and coordination costs. The choice between species-based and space-based access privileges involves explicit or implicit trade-offs between transaction costs and common-pool and stock externalities. While the bio-economic properties of species-based privileges (whether assigned as individual or group access) have been explored in detailed theoretical and empirical analyses and space-based group access privileges have received considerable attention in ethnographic studies, space-based group access privileges have not received much attention in bioeconomic analyses.

There are about 1734 TURFs in Japan and about 400 TURFs in Chile. The TURFs differ in size and complexity and in the suite of activities encompassed in the cooperative agreements among members of the group to which the harvesting privilege is assigned. To better understand the influence of design attributes of TURFs, the performance of space-based collective harvest rights is examined for nearshore shrimp fisheries in Japan and for loco fisheries in Chile. Adverse consequences of the race for fish in the small pink shrimp fishery off Japan stimulated the development of local fishery management organizations that encouraged cooperative management of harvests, investment in shared infrastructure, and pooled revenues. The most successful fishery management organizations engage in some form of catch pooling with joint ownership of vessels and processing facilities, quality control, branding, and collective marketing. The Chilean loco fisheries adopted a Management Exploitation Area (MEA) system after inadequate monitoring and enforcement led to the failure of an ITQ system. Successful

MEAs harvest less than the government-specified total allowable catch (TAC), enforce minimum size limits that exceed the official minimum size limit, and engage in predator removal and prey enhancement.

When group membership is well controlled and spatial boundaries are clear and enforced and little migration of the stock between regions occurs, space-based collective rights are a viable alternative to species-based individual quotas. In addition to fostering coordinated effort and marketing, cooperatives can provide incentives for collective stewardship. However, the actual outcomes depend on the ability to minimize transaction costs through internal coordination of spatial effort control, harvest timing, product quality, and social cohesion.

Human Ecology of Catch Shares: Intersections of Property, Community, and Environment
Bonnie McCay, Rutgers University

Management of Newfoundland groundfish, Baja California Sur lobster and abalone, and mid-Atlantic surf clam and ocean quahog fisheries provides examples of the complex roles of reciprocal effects and feedback loops in accentuating or attenuating resource crises. Intensified effort as a response to declining catch-per-unit effort (CPUE) in the Newfoundland groundfish industry (positive feedback) led to the collapse and closure of the fishery in 1992. Thereafter, the fishery experienced a socio-ecological shift towards crustacean fishing managed by limited transferable quotas assigned to areas and individual vessels, the success and feedback of which is yet to be determined. Initial failure to reduce harvest levels in the wake of low productivity during an El Niño event resulted in overfishing of abalone off the west coast of Baja California Sur, but informal co-management arrangements between local fishing cooperatives and government agencies allowed stocks to rebuild. In this case, the State and Federal governments reinforced self-governance within cooperatives. In turn, the fishing cooperatives stinted harvests by their members and policed fishing areas to deter illegal fishing. The mid-Atlantic surf clam and ocean quahog was the first major U.S. fishery to implement ITQs. Program design elements allowed for substantial concentration and consolidation. Productivity of surf clam and ocean quahog stocks appears to be declining in response to environmental change. The high degree of concentration has contributed to a long history of close involvement of industry in fisheries management policy and cooperative research. That is, because of their small numbers, fishing and processing companies recognize the close relationship between fishing and stock dynamics.

The fundamental question is: how do more privatized fishing rights intersect with changes in the philosophy and approaches of fisheries management? On the pessimistic side is the extent to which ITQs reinforce the commodity-orientation of fisheries management—the imperative to attain the highest level of production. They also tend to be organized around a single species; both in terms of stock assessments and in terms of quota allocations, and the problem of dealing with bycatch and highgrading in multispecies fisheries loom very large indeed. In addition, ITQs do not do away with incentives to cheat. However, ITQs can be the basis for creative institutional changes, particularly in the direction of bottom-up and collaborative arrangements. True partnerships between government agencies and groups of ITQ-holders have formed in many cases, and the incentives to participate in these arrangements and join searches for innovative technologies and management approaches to improve fisheries management are evident. Some

evidence indicates that the more secure, long-term "ownership" involved with ITQs does increase the owners' sense of stewardship and willingness to take part in joint efforts to learn more about the resource and adopt appropriate measures to protect it.

Applying Lessons from New Zealand to U.S. Limited Access Privilege Programs
Ralph Townsend, Winona State University

As the operator of the world's most comprehensive ITQ system, New Zealand offers significant experience that can inform the design and operation of U.S. limited access privilege programs (LAPPs). Under the New Zealand Quota Management System (QMS), 97 species are managed as 632 separate stocks. Two changes adopted in 2001 are especially relevant to the administration of any ITQ. Specifically, (1) the government separated the permanent quota right from the annual catch entitlement (ACE); and (2) a system of civil penalties, called "deemed values," was introduced to manage catch balancing.

In separating the allocated right (whether a permanent ITQ right or some less secure privilege) from the ACE, the government assigns a fraction of the TAC in the allocated right, and the actual number of pounds associated with that fraction varies from year to year, as the TAC for the fishery as a whole changes from year to year. This separation of the right and the ACE simplifies administration of virtually any catch monitoring system. This is true, whether or not ACE is freely transferable. Some aspects of the rights definition are appropriately attached to the allocated right, and other aspects of the rights are appropriately attached to the annual catching right. A system that tries to define only one right will inevitably run into unnecessary administrative complications (as New Zealand learned).

Most fisheries must deal with issues of bycatch management and unexpected catch overruns. The "deemed value" system enables harvesters to compensate the government for catch over the allowable limit, providing a mechanism for addressing overharvest. The New Zealand deemed value system has proven itself to be a remarkably flexible tool for catch balancing. Perhaps the key advantage of deemed values is the underlying philosophical shift from criminal enforcement to civil penalties. The use of deemed values as a balancing tool must acknowledge, however, that TACs may be exceeded by small amounts in any given year. The combination of ACE and deemed values dramatically reduced transactions costs in New Zealand fisheries and should be considered under any catch allocation/catch control system.

New Zealand has also taken active steps to devolve some aspects of decision-making and administration to industry. FishServe manages routine administration of the QMS. A few commercial stakeholder organizations have taken steps towards greater self-governance. But the transaction costs of self-governance have proven a serious obstacle. Government policy can reduce the high transaction costs of unanimous decision-making and provide better tools for self-enforcement. If the policy goal is to promote self-governance of fisheries resources to improve economic performance, then addressing these transaction costs should be on the policy agenda.

A Conversation about Rents as if "Communities" Mattered
Seth Macinko, University of Rhode Island

Catch share programs change access to fishery resources in ways that are often disadvantageous to few, part-time, and new participants. Because fisheries are based in communities, changes in how and when fisheries take place and changes in who is eligible to participate in fisheries affect communities. In considering the impact of catch shares on communities, it is particularly relevant to pay attention to communities as discrete local geopolitical units. At the same time, the public interests of the national community and human community and the shared interests of fishing sectors distributed through physical communities are also important.

Incentive-based fisheries management tools that have been designed to address some community concerns include sector management and community development quotas (CDQs). The outcomes of the implementation of New England permit banks and Alaskan CDQs led to discussion on the impacts of privatizing public assets and the associated rent dissipation – specifically, will private sector owners of public resources reinvest their profits in fishing communities.

A study on the fishing crew of the North Pacific red king crab fishery in Alaska informs this discussion and sheds light on the dynamics of "human communities." Rationalization through IFQs, processor quotas, and fishing cooperatives led to a fleet consolidation from 251 to 74 fishing vessels and an estimated reduction of 1000 crew jobs. Many of the job losses were seasonal, and crew in remaining jobs were able to work for longer seasons. For some, these changes resulted in more predictable income and "better" lifestyles. For others, these changes disrupted a valued way of life. When catch shares are defined as perpetual entitlements, they acquire a capital value that reflects future earnings. The capital value of catch share permits reduces the basis used to determine crew shares; that is, revenues go toward buying or renting the permit rather than toward compensating crew. The result is that the majority of financial benefits (rents) attributable to catch share programs accrue to the initial permit recipients. To date, the interests of crew and communities have not been reflected in the initial allocation of catch share permits. The policy design question for the western Pacific is to consider where should the rents go and why.

Fish Harvesting Rights-Based Management Programs in Canada: Lessons from Two Coasts and a Centre
Diane Dupont, Brock University

For more than 30 years, Canada has had experience with a number of different rights-based management programs for fish harvesting. These programs, spanning both coasts, have been applied to fisheries in the central region. While there are many successes to celebrate, there have been some failures that have provided opportunities for learning and adjustment. One important lesson is that regulators need to think about the entire suite of incentives facing fishers. In particular, they need to be aware of the entire fishing operation from harvesting to processing, since this provides the comprehensive context within which fishers make decisions.

A case in point has to do with the introduction of ITQs. Typically, some form of grandfathering is used and fishers are told that ITQs will be based on historical catches. Such information provides an incentive for overfishing in the short run. Initially, some form of auction may provide a better start to an ITQ fishery, particularly if the regulator wants to introduce the notion of a fisher being responsible for returning a share of the resource rent back to the state. Otherwise, fishers may believe that they are entitled to the fish *gratis*.

Consideration of catch share programs for Pacific Islands Region fisheries will be challenged by the lack of baseline data on catch histories. Such data are necessary, not only for the initial allocation of quotas, but also for the purposes of tracking subsequent transfers. Prior to introducing any catch share program, the regulators should consider the means by which monitoring of in-season catches and/or transfers will take place and be funded. This task is complicated by a blurring of the lines between full-time and part-time commercial fishers in the Pacific Islands Region; i.e., in cases where part-time commercial fishers catch fish primarily for their own consumption but offer surplus catch for cash sales. Any catch share program will need to build in flexibility of transfers between full-time and part-time participants and may even want to consider adopting components from the programs employed in British Columbia. Items such as the special consideration given to First Nations food fishery requirements and/or the holdback of a fixed share of the overall TAC from immediate allocation may be helpful to regulators of Pacific Regions Fisheries in their deliberations about the details of catch share programs.

A second lesson to be gleaned from the Canadian experience in setting up ITQ programs is that the regulator needs to be aware of the potential spillover effects onto unregulated species. Programs that make fishers responsible for their entire catches (whether or not they are targeted) are likely to be the most successful. Quota systems work best when the transactions costs associated with locating and transferring quota are low. Allowing third party middlemen to assist in the everyday operations of the market for quota leads to more efficient transactions; this solution appears to be working well in Canada.

Governments may have varied social objectives other than rent maximization, and the presence of these goals may require a modification of the catch share approach. For example, many of the fisheries in the Pacific Islands Region are conducted by community members for the purposes of primarily food and/or ceremonial fishing. Such fisheries may be best served not with a form of individual catch share but with community-based shares such as those employed in Nova Scotia (Ulrich and Wilson, 2009). The important aspect to keep in mind is that regardless of the type of regulatory program to be adopted, the incentive structure embodied within it must be sensitive to existing conditions and not operate at cross purposes. Aligning incentives with the status quo is the most efficient way forward and may well be seen to be the fairest; for many Pacific Region fisheries, this may be the most important aspect of any proposed change to the fisheries.

Catch Shares Experience: British Columbia Groundfish Fisheries
Bruce Turris, Pacific Fisheries Management Inc.

Catch share management systems were implemented in the British Columbia groundfish fisheries as an attempt to move towards sustainable fishing levels with significant economic benefit. Individual Vessel Quotas (IVQs) were introduced in the sablefish hook-and-line and trap fisheries in 1990; halibut hook-and-line fisheries in 1991; groundfish trawl fishery in 1997; and rockfish, dogfish, and lingcod hook-and-line fisheries in 2006. All groundfish IVQ programs were combined under one management system in 2006 with each fisherman awarded a transferable share of the TAC for each of the 60 species. The following are key guiding principles of the IVQ system: all groundfish catches must be accounted for, that groundfish are managed on a stock-specific basis, and that fishermen are individually accountable for their catches. Catches are subject to dockside and at-sea monitoring. Initial allocations of quota shares were based on catch history and vessel size, according to a consensus of participants in each fishery. Some fishermen have diversified the species that they target, while others have traded quota to gain a large share of one or few species. In British Columbia, the system resulted in reduced fleet and fishing effort with fewer vessels fishing less ground more selectively. The extent of consolidation ranged from 50% to 60% in the sablefish and halibut fisheries to nearly 90% in the rockfish fishery. The dramatic consolidation of rockfish was largely a result of the use of rockfish IVQ to support retention of rockfish bycatches in other groundfish fisheries.

Catch shares can be effective tools when they are designed to meet definite objectives. While many features contribute to the success of catch share programs, transferability is essential for multispecies fisheries. Canadian IVQ programs have evolved over time, often beginning with restrictions on consolidation and transfer that have subsequently been relaxed. The opportunity to revise program features relieves some of the pressure during initial program design. Transition to a catch shares program may require costly investment in enforcement and monitoring capacity; these costs may need to be borne by government during the transition. Like some New Zealand programs, and in contrast to U.S. programs, some program management and data functions have been contracted to third parties. Setting allocations among commercial, sport, and first-nations interests is a prerequisite to the establishment of a stable catch- share program within the commercial sector.

Rational Collaboration at a Sea of Irrational Competition: Pacific Whiting and the West Coast Groundfish Fishery
Gil Sylvia, Oregon State University

Through the mid-1990s, the Pacific whiting fishery off Oregon and Washington was characterized by a "race for fish." Despite a moratorium on entry, it resulted in overfishing and overcapitalization and caused the fishery to generate substantially less than its potential level of regional and national net benefits. Allocation wars between inshore and offshore sectors were settled in 1996 when the Pacific Fishery Management Council (PFMC) divided the whiting catch via a 5-year sector-based allocation. In 1997, after the Department of Justice concluded that voluntary subdivision of the offshore sector allocation would not constitute a *per se* violation of antitrust law, the Whiting Conservation Cooperative (WCC) was formed. The WCC was

structured around a contractual agreement to subdivide the sector allocation into individual transferable quotas, based on catch history and other considerations. Under the WCC fishing companies retired or redirected catcher-processor capacity. As a result, the fishery increased from a 3-week derby to a leisurely 4-month season, product recovery rates increased, profits and revenues increased, and bycatch decreased. Although the WCC is a voluntary private agreement, it is backed by the force of civil contracts, complete with penalties for failure to honor agreed to terms. Transaction costs to develop the WCC were kept low by the small number of players in the fishery and the level of trust they had developed while jointly lobbying the PFMC for a favorable sector allocation.

Rationalization of the remainder of the west coast trawl fishery, to be implemented in 2011, combines IFQs for the inshore sector and harvest cooperatives for the offshore sectors of the fishery. Ten percent of the non-whiting IFQ has been set aside to facilitate the entry of next-generation fishermen, to offset adverse impacts to processors, protect communities, and provide incentive for bycatch reduction and habitat protection. This example demonstrates that ITQs, cooperatives, and other catch share management tools can coexist within a fishery and that they can be used in conjunction with other management approaches depending on the objective of the fishery.

Assigning Rights and Responsibilities in Fishery Catch share Systems: Individual Quotas vs. Harvest Cooperatives
Dan Holland, Gulf of Maine Marine Research Institute

Building on experience from the Pacific whiting and Alaska pollock fisheries, the New England Georges Bank fixed gear codfish fishery implemented sector-based harvester cooperatives in 2004. In 2010, 17 of the remaining groundfish sectors are expected to adopt the system; in total, sector-based management will encompass more than 95% of the TAC for New England groundfish. The fishery was previously managed under an input control-oriented system, based on individual allocations of days-at-sea but failed to focus effort on strong stocks and away from weak stocks. The groundfish catch share system provides flexibility and variety among sectors. Many have implemented internal ITQs, allocating annual catch entitlements to members and often allow external trading among sectors.

One major disadvantage of sectors relative to IFQs is the weak property rights that they confer in terms of exclusivity, transferability, durability, and security. Potential sector contributions can only be used within that sector and individuals can be excluded from any and all sectors, being relegated to a residual open access pool. Advantages of sectors include the flexibility and diversity in the system and the potential for real-time development of management approaches. Trading systems organized by sector managers reduce the transaction costs for trading annual catch entitlements. Sectors can increase bargaining power by joining with processors to provide a means for organizing fishing to meet market needs. By comparison, the New Zealand Quota Shares Management system offers stronger property rights, greater economic efficiency, lower transaction costs and ease in transfers. New Zealand's deemed values system increases compliance and eliminates incentive for illegal discarding.

Cooperatives provide flexibility to meet divergent objectives of subgroups in a fishery. The joint and several liability associated with cooperatives transfers some of the compliance costs and risk to fishers but may improve compliance and reduce overall monitoring and enforcement costs. Cooperatives provide an institutional structure to implement collective action to increase value of landings. Given sufficient legal and institutional support, IFQs and cooperatives are likely to evolve into a hybrid system which encompasses the benefits of each system.

Designing Catch Shares for Conservation—A Look at the Gulf of Mexico Red Snapper, Grouper, and Tilefish IFQ Programs
Kate Bonzon, Environmental Defense Fund

Following a six-step design manual developed by the Environmental Defense Fund, a species-based catch share IFQ system was implemented in the Gulf of Mexico red snapper fishery. Prior to IFQ management, the red snapper TAC was exceeded in 9 out of 17 fishing seasons; the fishery was characterized by overfishing, derby seasons, and high discard rates. Transferable long-term IFQ shares and annual IFQ allocations were implemented in 2007; shares were based on historical participation and included a consolidation cap equivalent to the leading industry participant's historical catch. Monitoring and enforcement of the red snapper management program is through vessel monitoring systems, a hail in-hail out requirement (reporting departure and return dates for trips), and a 3% cost recovery fee collected by dealers at the time of each sale. The IFQ shares management in the Gulf of Mexico red snapper fishery has led to decreased bycatch, a year-round fishing season, increased ex-vessel prices, and an increased TAC for the entire fishery. The commercial sector has not exceeded TAC since the program began, and the Gulf of Mexico Shareholders Alliance was formed by fishermen. Evaluation of the recreational and charter industries' applicability to catch share systems is currently underway. Catch shares provide incentives for fishermen to comply with fishing regulations, maintaining healthy fish stocks through changed behavior.

Pacific Rim Catch Share Programs, 1986-2006: Some Lessons for the Pacific Islands?
Chris Dewees, University of California Davis

A review of case studies in New Zealand and British Columbia suggests some lessons to be learned in catch share program design. After ITQs were implemented, researchers conducted in-person interviews of fishing business owners and community members in both countries, combined with mail surveys in British Columbia, to identify lessons for development of catch share programs in other regions.

The New Zealand quota management system (QMS) was developed following a moratorium on new entrants, a purge of part-time fishermen, and distribution of deepwater enterprise allocations. Facing an economic crisis, as well as an overfishing crisis in its nearshore fishery, New Zealand had incentive to develop its deepwater fishery but needed to do so without increased cost to the government. As initially designed, the New Zealand system resulted in increased value-added production and the development of new product markets but suffered from problems with high-grading, bycatch, black-market sales and limited information to use to

set TACs. Revisions to the program came about at about the same time as settlements were reached with the Maori regarding treaty rights to fishery resources. Program revisions included a switch from efforts to fund management and enforcement, using resource rents to conducting those functions on a cost-recovery basis.

Prior to the Individual Vessel Quota (IVQ) program, British Columbia operated under limited entry with 435 vessels, low ex-vessel prices, and a race for fish. Catch shares were allocated, based on catch history and vessel size and were not transferable during the first 2 years of the program. Initial outcomes of the catch share program included reduced effort, longer seasons, an end to the race for fish, a shift from frozen to fresh markets with an accompanying increase in ex-vessel prices, and (especially in British Columbia) a feeling of increased welfare among license holders after implementation of catch shares. Continued operations by the Alaska halibut fishery under an open access regime from 1991 to1994 helped boost ex-vessel prices for Canadian fishermen; once IFQs were implemented in the Alaska halibut fishery, Canadian ex-vessel prices declined but remained well above their pre-IVQ levels.

In catch share program design, the most important consideration prior to implementation is to decide the fisheries objectives and desired outcomes. Initial allocation is difficult but the efficiency gains suggested in economic theory are realized in practice. In the design of a catch share program, it is important to consider tools to attract talented new entrants/quota owners into fishery as current participants age and retire. To the extent feasible, it is important to incorporate noncommercial users (recreational, First Nations groups, ecosystem needs, etc.) in the system or to devise mechanisms that allow for compensated shifting of allocations among sectors.

Catch Share Programs in Alaska
Glenn Merrill, NMFS/AKR

Contrary to many other catch share management examples, overfishing was not the driver behind management reform in the Alaskan fisheries. Instead, catch share design and implementation aimed to settle allocation disputes, enhance economic returns, address safety concerns, and reduce bycatch. The first program, the halibut and sablefish IFQ program, encompassed nearly 3000 initial participant allocations divided by various area and vessel size quota. Controversy was generated by smaller-than-anticipated allocations that arose from liberal criteria for determining eligibility and catch history. Additional controversy arose resulted from the delay between council action (1991) and actual implementation of the program (1995); during the period between council action and program implementation, new fishermen entered the fishery on the speculation that eligibility criteria would be revised. Both the industry and policy makers experienced a steep learning curve, especially in terms of reaching out to such a large number of participants in very remote areas. Further developments in Alaskan catch share programs included the Western Alaska Community Development Quota (CDQ) program (1992), Bering Sea and Aleutian Islands (BSAI) pollock cooperatives (1999), scallop limited-entry cooperatives (2000), Gulf of Alaska halibut Community Quotas (2004), Bering Sea crab IFQs and Processing Quotas (2005), Gulf of Alaska rockfish cooperatives (2007), and the BSAI non-pollock trawl cooperatives (2008). Each program was developed to address unique needs and objectives while allowing for some integration and overlap. The introduction of catch share programs in Alaska

came at a time of acceptance towards TAC management in large industrial, capital-intensive, commercial fisheries. The movement towards catch shares was industry-driven and led by a consistent group of players representing similar interests. Some key themes to consider from the Alaskan experience include the importance for industry involvement and political partnerships to bridge information gaps, as well as early planning in terms of program infrastructure and implementation. Policy makers must expect the unexpected and remember to plan accordingly for the time it takes to develop and implement the programs. Program flexibility is important given the rapid changes known to follow management implementation.

Law Enforcement Considerations for Catch Share Programs,
Sherrie Myers, NMFS Enforcement

For a law to result in desired behavior, it must be coupled with the "Three E's of Enforcement": education of the public, engineering laws in a way that encourages compliance, and enforcement that effectively deters violations. Compliance with and enforceability of regulation is strengthened by simplicity and comprehensiveness of laws, limited exceptions, fewer numbers of regulations, and education of enforcement and penalties. In the Alaskan halibut and sablefish programs, common IFQ violations have included high grading of fish, fishing outside of permit areas, falsifying logbook or violations, catching above the quota (overages), fishing without IFQ permits, fishing sans permit holder onboard, retaining undersized fish, and landing without prior notice or at an undesignated port. Some lessons can be learned from previous catch share experiences in terms of enforcement, especially the importance of defining terms such as landing, off-loading, and ownership. Clarity about unwanted behavior (strictly prohibiting it) allows for effective enforcement of the law. It is important not to underestimate the creativity of the fisherman's mind in terms of finding loopholes in the regulation. Monitoring, auditing, and enforcement of catch share programs is labor intensive and the available resources are often overestimated. For catch share programs, accountability and enforceability from harvester through wholesaler would enable interception of unlawful product. Different aspects of catch share programs require different enforcement assets—dockside monitoring and at-sea monitoring by aircraft and surface vessels. Tools such as VMS greatly facilitate enforcement of open and closed areas. Restrictions on where catches can be landed greatly facilitate dockside monitoring. Real-time debiting of catches against annual catch entitlements reduces the frequency of overages and ensures that overages are detected when they occur. Deemed value systems or provisions for deducting overages from future annual catch entitlements can help a fishermen deal with occasional unintentional overages and allow enforcement to focus on egregious violations.

Formal and Informal Catch Shares in Alaska's Groundfish Fisheries
Keith Criddle, University of Alaska Fairbanks

The introduction of catch shares in fisheries off Alaska has transformed fisheries and fishing communities. Although the specific motivations that led to the adoption of catch shares have varied, in each case concern was shown regarding overcapitalization in harvesting and processing, season compression or grounds congestion, depressed product prices, product

recovery rates, and product quality. Implementation of catch shares has been controversial. There has been controversy over windfall gains to recipients of catch share entitlements. There has been controversy over the criteria used to determine eligibility. There has been controversy over rules used to link catch shares to catch history. There has been controversy about the effects of catch shares on processors, crew, and communities. There has also been controversy over differences between federal and state law. Federal law allows for the development of catch share programs for species subject to a federal Fishery Management Plan (FMP). State law has been interpreted to prohibit the creation of catch share programs in fisheries managed by the state. This has created potential conflict in parallel fisheries—fisheries for species that occur in federal and state waters and are subject to federally permitted fishing in federal waters and state-permitted fishing in state waters.

The State of Alaska introduced a limited-entry program in salmon and herring fisheries in the 1970s. While these programs limited the number of participants, they failed to control overcapitalization, the race for fish, season compression, or grounds congestion. Limited-entry and vessel moratoria programs are not catch shares programs, but experience with state limited-entry programs was influential in the design of federal catch share programs for fisheries off Alaska. Excess capitalization under the state limited-entry programs spilled over into fisheries such as the halibut fishery, thereby accelerating the descent of that fishery into a 2-day derby.

When IFQs were introduced in the halibut and sablefish fisheries in 1995, more than 3000 individuals received catch shares based on an average of their catch history in the years prior to Council approval of the IFQ program in 1991. The number of participants and number of active vessels quickly declined, ex- vessel prices increased, wholesale product markets changed from frozen to fresh, bycatch discards declined, and safety improved. There were more than 1000 appeals by individuals who did not receive IFQs or received less than then they felt they were due. The program successfully withstood court challenges regarding the criteria used to determine eligibility and catch history. The evolution from frozen to fresh markets left traditional processors ill-equipped to compete at a time when they were already reeling from substantial reductions in world salmon prices. Processors' dissatisfaction with this outcome has flavored the structure of all subsequent catch share programs in Alaska. Cessation of the race for fish, coupled with the decline of the salmon industry and development of new market channels for halibut and sablefish, eliminated the conditions that had favored growth of small ports adjacent to fishing grounds and a consolidation of deliveries into larger, better-equipped, and better-connected ports. The flight of IFQ permits from these coastal communities led to the creation of a Community Quota Shares (CQ) program in 2004. However, while the CQ made community quota entities eligible to buy and lease quota shares, they had to acquire those shares through purchases from IFQ holders. To date, only one community entity has acquired CQ. There continue to be concerns that the interests of communities are not taken into account in the private decisions of IFQ holders about where to live, homeport their vessel, or sell or otherwise dispose of their quota shares, but there was nothing about the derby fishery that assured consideration of community interests either.

The Community Development Quota (CDQ) program was created in 1992 with the intent to foster economic development of 65 economically disadvantaged communities in western Alaska (Ginter, 1995; NRC, 1998). As initially approved, the program allocated 7.5% of the BSAI

pollock TAC to six CDQ entities representing the eligible communities. The CDQ entities lacked the capacity to harvest pollock but were authorized to lease CDQ shares to the highest bidder. The CDQ program has since expanded to include a 10% allocation of all BSAI groundfish TACs. CDQ entities have become very profitable—in 2009, CDQ entities earned more than $180 million on net assets of about $500 million and generated local payrolls of about $35 million. CDQ entities have supported the construction of small fish processing plants in western Alaska, provided loans and other support for the development of small boat fisheries based out of western Alaskan communities, and invested in large catcher vessels and catcher processors that are active in pollock and other groundfish fisheries. As of 2009, CDQ entities held more than a 50% ownership position across firms in the catcher-processor sector of the BSAI pollock fishery.

The American Fisheries Act (AFA) (1999) created a catch share program in the BSAI pollock fishery by setting a permanent allocation between inshore and offshore sectors and CDQs. The Act authorized development of cooperatives within each sector and authorized subdivision of sector allocations into transferable individual vessel allocations. Under the AFA, product recovery rates have increased 150%, discards have declined, bycatch has declined, product quality has increased, and production has shifted from low-value product forms to higher-value product forms.

The scallop limited-entry program (2000) is an example of an informal catch share program. When this program was in development, a moratorium on creation of catch share programs for FMP fisheries was in effect at this time. In establishing this limited-entry program, the Council was aware that very few vessels were involved in the fishery and that the vessel owners had agreed to operate as a cooperative—divvying up the annual TAC among themselves rather than racing one another for shares of the catch. The cooperative has functioned successfully since it was created.

The Bering Sea crab rationalization program (2005) is the most controversial catch- share program in Alaska. The program includes harvesting quota shares issued to fishing vessel owners and to skippers, processing quota shares issued to onshore and floating processors, and allowing communities a first right of refusal on the transfer of processing quota shares from local plants. The number of actively fished boats fell more than 50% immediately after the program was implemented. Controversy continues to turn on the effect of this program on the number of crew positions and whether the decrease in seasonal positions was offset by increases in full-time positions.

The Gulf of Alaska (GOA) rockfish cooperative (2007) is an IFQ program masquerading as a pilot or experimental program. It has escaped loud controversy because it involves a small number of vessels from one community fishing in an area adjacent to the community. The BSAI non-pollock trawl cooperatives (2008) were patterned after the AFA cooperatives but adopted through normal Council processes rather than by congressional fiat. Throughout the previous decade, the BSAI non-pollock trawl sector operated under a voluntary cooperative agreement to avoid bycatch. Amendment 80 to the BSAI groundfish FMP provided a basis for formally recognizing the voluntary cooperative arrangements and provided additional authority to sub-allocate target species catches.

The variety of catch share programs in Alaska is illustrative of the degree to which catch share programs can be designed to meet multiple social and financial objectives. Just as there are winners and losers in the race for fish, there also are winners and losers in the political processes used to devise sector allocations. Conscious consideration of potential winners and losers is important for the Council to weigh against objectives of sustainable fisheries and sustainable fishing communities. The seas are not boundless and the fishery resources they encompass are finite. Experience suggests that in the absence of effective controls on catches, fisheries will be depleted. Experience also suggests that reliance on limits to seasons and numbers of vessels or amount of gear leads to a race for fish that dissipates value and can threaten the ability of managers to hold catches below a TAC.

AN INTRODUCTION TO PACIFIC ISLANDS REGION FISHERIES

An Overview of the History, Development, and Current Status of Pacific Islands Region Fisheries

Paul Dalzell, Western Pacific Regional Fishery Management Council

The western Pacific region includes more than 50% of the U.S. Exclusive Economic Zone. The four principal fishing areas are Hawaii, American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI). Fishery production, both commercial and noncommercial, is dominated by pelagic fishing, although bottomfish, reef-fish and other non-pelagics are important both economically and culturally. The average catch from these fisheries is 39.1 million pounds with an average ex-vessel value of $83.5 million. By weight, pelagics account for 96% of all western Pacific region landings. Hawaii has the largest and most diverse pelagic fisheries. The largest fishery is a longline fishery that targets swordfish and bigeye tuna. Other fisheries off the Hawaii shores include ika-shibi handlining for yellowfin; palua-ahi handlining for yellowfin and bigeye tunas; trolling for tunas and other pelagics; pole-and-line fishing for skipjack; deep slope handlining for large snappers, jacks, and grouper; and netting, hooking, trapping, and spearing coral reef-associated species by various fisheries. Charter fisheries off the coastlines of Hawaii account for substantial catches of, mostly, pelagic species, such as blue marlin. The second largest fishery is the albacore longline fishery offshore of American Samoa. An emergent longline fishery is now operating in the CNMI. These areas and Guam also have a mix of troll and handline vessels targeting pelagic and benthic species. All fisheries have become increasingly constrained by the closures of fishing grounds through the creation of marine national monuments and other marine protected areas.

Baseline Economic Information on Commercial Fisheries in the Pacific Islands Region

Minling Pan, NOAA Pacific Islands Fisheries Science Center

The Pacific Islands Region is bounded to the north by the Hawaiian Archipelago, the south by American Samoa and the U.S. Pacific Remote Island Areas (PRIAs), and to the west by the Marianas Archipelago including Guam and the Commonwealth of the Northern Mariana Islands (CNMI). This area with 1.5 million square nautical miles of EEZ waters is composed of about

half of the total area of the U.S. EEZ. Fisheries in the Pacific Islands EEZ are economically and culturally important to the people in the region. The total value of the commercial fisheries landings in the Pacific Islands Region was nearly $100 million in 2008. Because of the high quality of the tuna and swordfish harvested by the Hawaii-based longline fishery, Honolulu ranks among the nation's top 10 fishing ports. The largest Pacific Islands fishery is the pelagic fishery: Hawaii accounts for 66% of pelagic landings, American Samoa 32%, and Guam and CNMI 1% each.

Overfishing has not been a significant challenge to fisheries management in this region until recent years when concern began to grow about the main Hawaiian Islands (MHI) bottomfish stock and the bigeye tuna stock Pacific-wide. To date, none of the fisheries operates under a catch share program. The Western Pacific Fishery Management Council listed six commercial fisheries as potential candidates for catch share programs in the Pacific Islands Region. These fisheries included: 1) Hawaii-based longline, 2) American Samoa longline, 3) Guam longline, 4) Guam bottomfish, 5) Hawaii pelagic seamount, and 6) MHI bottomfish. These six fisheries constitute the main commercial fisheries in the region; they range from large-scale, full-time commercial fleets that fish on the high seas to small scale, to part-time fleets that fish within 20 miles of shore. Not only are these fisheries diverse in their geographical locations and production scales, but they also employ a variety of fishing technologies, involve different numbers of players (fishermen) within a fleet, feature different development trends, serve different markets, and reflect a range of economic statuses.

The Hawaii, American Samoa, and Guam/CNMI longline fisheries operate at a large commercial-fishing scale, with vessel size ranging from 50 ft to 100 ft in length. Currently, the Hawaii and American Samoa longline fisheries are managed by limited-entry programs based on the number of permits and number of vessels, respectively. The Hawaii longline fishery was the largest commercial fishery in the region with a landings value of $74 million in 2008. Hawaii longline vessels fish in both the U.S. EEZ and in international waters across the jurisdictions of two regional fisheries management organization (RFMOs): Western and Central Pacific Fisheries Commission (WCPFC) and the Inter-American Tropical Tuna Commission (IATTC). Currently, the Hawaii longline fishery is subject to quotas on bigeye tuna catch set by each RFMO, respectively. In 2010, the bigeye tuna quota was 3763 metric tons in the western Pacific Ocean and 500 metric tons in the east Pacific Ocean for vessels longer than 24 m (78.7 ft). FAO data indicate that annual bigeye tuna landings of the U.S. longline fishery(primarily from the Hawaii longline fleet) contribute 7.5% of the total bigeye tuna catch in the entire Pacific.

Cost-earnings studies were conducted periodically on main commercial fisheries in this region. Those studies showed that the commercial fisheries had only a small profit margin. For example, the cost-earnings study on Hawaii longline fisheries showed that a Hawaii longline vessel had an average of $486,000 in annual revenue from its 2005 operation. After subtracting the trip expenditures, fixed costs (without considering depreciation), and payments to crew and captain, the remaining earnings to the vessel owner were approximately $25,000 per year. Assuming the fishing vessel as the primary investment, the return to investment was about 7%.

In contrast to the longline fisheries, the Guam bottomfish, Hawaii bottomfish, and Hawaiian pelagic seamount fisheries are small-scale fisheries. The region's small-scale commercial

fisheries feature a large number of part-time commercial and recreational fishermen. The small scale commercial fisheries play a significant social and economic role, given their large number of participants and the culture of sharing catch among families and friends. The catch from small-scale fisheries often serves as an important source of food for the people in this region. Therefore, culture and fishing as a lifestyle are significant, especially to the part-time commercial fishermen.

Social Considerations for Adopting Catch Share Programs in Hawaii and the Western Pacific
Stewart Allen, NOAA Pacific Islands Fisheries Science Center

A current NOAA Fisheries priority is consideration of catch shares for fisheries that have a quota or annual catch limit. Currently, there are no catch share programs in federal fisheries in the western Pacific. However, the Western Pacific Regional Fishery Management Council has recommended that catch shares be considered as a management option for the Hawaii-based deepset (tuna) longline fleet, which is operating under an internationally set quota. Catch share programs have successfully addressed a range of issues in many fisheries, such as overcapacity, a race to fish, poor product quality, safety concerns, and low economic returns, but have also raised concerns such as effects on fisheries employment (especially crew), the ability to enter the fishery, and the ability for fishermen and communities to continue their lifestyles and relationships to fishing. The characteristics of the deepset longline fleet are evaluated to determine whether the fishery exhibits the problems that catch share programs are commonly designed to address. The results suggest that many of the problems that have led to catch share programs are not present in the Hawaii-based fishery, but that some warning signs exist that could be addressed through catch share programs. In addition, some of the community and lifestyle problems created by catch share programs elsewhere may not be as significant in Hawaii.

Administering the Hawaii Longline Shallow-Set Certificate Program - KISS or not KISS?
Walter Ikehara, NOAA Pacific Islands Regional Office

In 2004, the NOAA National Marine Fisheries Service (NMFS) Pacific Islands Regional Office, implemented a program developed by the Western Pacific Fishery Management Council, NOAA Fisheries, and the Hawaii longline industry to reopen the swordfish longline fishery in Hawaii. The swordfish fishery had been closed based on concerns over injuries and mortalities of protected sea turtle species. NMFS implemented a limit on the take of loggerhead and leatherback turtles and a limit on fishing effort by capping the number of shallow-sets targeting swordfish. NMFS capped the annual number of shallow-sets by issuing a limited number of shallow-set certificates. A total of 2120 certificates are issued in equal parts to eligible permit holders who request certificates. Of the 164 eligible permit holders, only 122–142 request certificates, so each requester receives between 15 and 17 certificates per year. In a typical year, vessels that use certificates use an average of 16-17 certificates per trip. As a result, vessels receive only enough certificates to cover one swordfish trip per year. Consequently, active fishermen who want to take more than one swordfish trip must acquire certificates from those who request certificates but do not intend to fish their certificates. Because only approximately

28 of the 122 to 142 vessels who request certificates actually use them, fishermen typically can buy certificates from other vessels. In fact, the fishermen who target swordfish typically make 3.5 swordfish trips using (in part) certificates purchased from other vessels. The supply of certificates exceeds demand and thus prices are relatively low. Specifically, shallow-set fishermen only use 75% –80% of the available certificates, and market prices for certificates are reported to be no more than $100–$150. The substantial costs of printing certificates and tracking their usage would be less if certificates were only issued to active shallow-set fishermen. However, restricting the distribution of permits to a narrow segment of the eligible permit holders could seem inequitable to eligible permit holders who are not currently active in the shallow-set fishery, but might derive value from the option of participating in the shallow-set fishery.

Observations on Cross Seamount: A Case of the Constraints Facing and Adaptive Strategies of Hawaii's Offshore Handline Fleet

Janna M. Shackeroff (presented by Craig Severance), University of Hawaii

The pelagic fishery on Cross Seamount is one of the six western Pacific fisheries listed as a potential candidate for a catch share program. This small-boat tuna fishery evolved from the traditional handline fishery (near shore), known as *Ika-Shibi*. This fishery set on private fish-aggregating devices (PFADs) at Cross Seamount, around the islands (mainly around the Big Island), and around weather data buoys. Six small boats fished in this far-offshore zone in the beginning period of this fishery (1980s). In the mid-to-late 1990s, the number of fishing boats increased to as many as 20. Since the late 1990s, however, as a result of resource challenges and increases in trip costs incurred based on the greater distance to the fishing grounds, the number of fishing vessels in these areas decreased. By 2007, only five captains reported landings from Cross Seamount. The small fishable area over Cross Seamount creates a need for formal or tacit cooperation among fishing vessels to avoid entangling gear. The long distances from port and small size of the participating vessels also encourages vessels to offer good samaritan support to each other on the fishing grounds. These preexisting characteristics of the fishery could be reinforced with a suitably configured individual or cooperative catch share program, but given the small number of participants, such cooperative agreements may emerge without need of involvement of the Western Pacific Regional Fishery Management Council. The Council could lend support to self-organized cooperatives through closing entry.

Fisheries off Guam

Paul Callaghan, University of Guam

Guam, the largest and southernmost of the Mariana Islands, is one of five U.S. territories. It is a melting pot for different ethnic groups, with the largest ethnic group (the native Chamorros) accounting for 37.1% of the total population. Fisheries off Guam are small scale, with great species diversity in the catch and low commercial value. High social importance is attached to noncommercial catch, frequent non-commercial fishing (recreational and subsistence fishing), and a cultural heritage that fishers follow. About 90% of the fishers in the island fish only once a week, and they (recreational, subsistence, and even commercial fishers) commonly share their

catches with relatives and friends. Sharing is an acknowledgement that fish belong to the people as a whole, not just to the fisher; sharing reinforces social bonds and elevates the stature of successful fishers. One risk of a catch share program is that it could strengthen private rights to the detriment of social rights implicit in the practice of sharing catches. Any catch share program for fisheries, such as those off Guam, must balance program features that may reduce economic efficiency against program features designed to ensure social benefits.

SUMMARY OF THE FACILITATED DISCUSSION

The last 2 days of the PIFSC Catch Share Workshop involved a facilitated discussion among participants to elaborate on presentations and discuss management options for the region. It was not the intent of the discussion to establish regulations or formally advise WPFMC but rather as a forum to exchange and explore ideas and information. Three initial questions were posed at the beginning of the discussion session:

1. What are the applicability, feasibility, and desirability of catch shares as a structure for management of the Pacific Islands Region pelagic fisheries, bottomfish (demersal) fisheries, and reef fisheries?
2. What social structures, characteristics, and objectives are best supported by catch shares rather than other fishery management structures?
3. What life history (recruitment, maturity, natural mortality, migration, etc.), stock assessment, and catch accounting capabilities are needed to warrant consideration of catch shares as a management structure?

The discussion provided a chance for participants from the Pacific Islands to express their management needs and concerns for catch share programs and the opportunity for guest participants to prescribe possible alternatives to address those needs. This summary outlines the common themes and overall outcomes of the workshop discussion.

Management Needs and Main Concerns for Catch Share Tools in the Pacific Islands Region

First, when considering fisheries management through catch shares in the Pacific Islands Region, the complexity of the region poses a concern. The area consists of a mix of industrial and subsistence characteristics across pelagic and bottomfish fisheries. Some fish species could be targeted by diverse fleets with different operation scales. For example, the industrial-scale Hawaii longline fishery caught large amounts of pelagic fish such as bigeye tuna, yellowfin tuna, and mahimahi (*Coryphaena hippurus*), which were also harvested by the small boat fishermen. At the same time, there is a nearly continuous gradation from the full-time and part-time Hawaii small boat fleet to the charter and personal recreation fleets.

Second, participants from the region expressed concern that cultural institutions and "way of life" might be overlooked in the allocation of catch shares. Participants also discussed the unintended effects experienced by fishing communities with previously implemented catch share programs. One major inquiry to catch share experts was how catch shares in other areas have affected communities and individual rights.

Third, while logbooks provide information for the Hawaii longline fishery, data infrastructure is weak for other fisheries. Even though the Hawaii longline fishery has a long period of logbook records, it could still be difficult to trace catch history associated with each permit holder. The logbook information recorded fish caught in numbers and not by weight, and the longline fishing permits could be leased and transferred among fishermen or fishing vessels. The question was raised whether the lack of data would contribute to unfair distribution of quotas.

Fourth, the main fisheries in the area were multispecies and involved many fishermen. The Hawaii pelagic fisheries and the main Hawaiian Islands (MHI) bottomfish fishery are examples. The MHI bottomfish stock complex is considered locally depleted for a subset of species known as the "Deep 7." The MHI bottomfish fishery is managed by a total allowable catch (TAC) set annually.

> *The TAC for the 2010-11 fishing year of 254,050 lb (115,235 kg) of Deep 7 bottomfish in MHI was proposed. Discussion of catch share potential in the MHI bottomfish industry involved a comparison between dealing with the Deep 7 species, including* ***onaga*** *(Etelis coruscans),* ***ehu*** *(E. carbunculus),* ***opakapaka*** *(Pristipomoides filamentosus),* ***kalekale*** *(P. sieboldii),* ***lehi*** *(Aphareus rutilans),* ***gindai*** *(P. zonatus) and* ***hapuupuu*** *(Epinephelus quernus), on a single species base or multispecies-based program. Additional species of Hawaii bottomfish that are federally regulated include* ***uku*** *(Aprion virescens),* ***white ulua*** *(Caranx ignobilis),* ***black ulua*** *(C. lugubris),* ***butaguchi*** *(Pseudocaranx dentex),* ***taape*** *(Lutjanus kasmira),* ***yellow tail kalekale*** *(Pristipomoides auricilla) and* ***kahala*** *(Seriola dumerili). These species together are collectively known as the Bottomfish Management Unit Species (BMUS).*

In addition to multiple species, the MHI bottomfish fishery involves many fishermen. A total of more than 1000 people are considered to have been involved in the fishery because the population is defined as anyone who has or has held a Hawaii State Commercial Marine License (CML) and reported any BMUS catch since November 2008, as well as anyone who has ever purchased a noncommercial bottomfish permit (not necessarily currently valid). Currently, TAC was implemented by seasonal closure at the date when TAC was reached. Participants expected that since the fishery operates in U.S. federal and state waters, mandatory ACLs are on the horizon. Concerns over management of this fishery include the structure of the permitting system, data records, and other implementation issues. Compared to the MHI bottomfish, the pelagic fishery in Hawaii is even more diverse in terms of the combined recreational, commercial, and part-time commercial structure, making it more difficult to determine a basis for awarding quota shares.

Catch Share Options for the Pacific Islands Region

Workshop participants offered several suggestions for consideration of possible catch share programs within the Pacific Islands Region. Drawing on experiences with catch share programs from elsewhere in the United States and around the world would provide understanding of how specific program design features affect program outcomes, such as the distribution of benefits and costs and the ease of access for new entrants. The worldwide tableau of catch share programs includes programs with many different forms, features, and goals. Catch share programs should be considered as an element of a toolkit for fisheries managers; development of catch share programs should not be an end in itself but should instead be a possible means of accomplishing objectives related to the sustainable management of fisheries. Thus, the first step by the Pacific Islands Region is to clearly identify the goals and objectives of each fishery. Fisheries managers should then identify changes in fisheries management that need to be addressed in the next 5 years, and whether catch shares can facilitate those changes. Where appropriate and with clear objectives, the features of a catch share program can be tailored to support management objectives.

Involvement by community and industry representatives is essential at every stage—from setting objectives to determining whether catch shares are a viable means of achieving those objectives, to the design and implementation of a catch shares program. Providing local fishermen and other stakeholders with opportunities to talk with fishermen from regions where catch share programs have been adopted can be a very effective means of helping local fishermen understand the consequences of a transition to catch shares. Discussion of catch shares without involvement of fishermen and other stakeholders can lead to erroneous assumptions about how the fishery will evolve under a catch share program. For example, fishing effort has often consolidated more rapidly than anticipated by fishery managers; more discussion with current fishermen could have provided a better prediction of who would leave the fishery and who remain following implementation of catch shares.

Several participants suggested that sector allocations—catch shares allocated to sectors rather than individuals or communities—could be a useful management option for the bottomfish Deep 7 fishery, given its mixed structure of commercial, part-time commercial, and recreational fishermen. The allocation of shares in the commercial sector fishery could be based on catch history or equal shares of the sector allocation. Allocation among the recreational and part-time recreational/commercial sectors would be more challenging based on less agreement on a basis for allocation of catch shares within these sectors and the lack of participation records that could serve as basis for within sector allocations. Moreover, it could be difficult to enforce a fixed sector allocation on the recreational fishery with only effort limits or daily bag limits without also providing fishery managers with the authority to close off recreational fishing as the sector allocation is approached. Nevertheless, it appears that mandatory Annual Catch Limits (ACLs) are on the horizon for this fishery since it operates in state and federal waters. Additional constraints by ACLs will change the dynamics of Deep 7 management. Catch share options for the Deep 7 vary since the programs could be species-based or multispecies, treating the Deep 7 as a whole. The bottomfish industry needs to first address implementation issues such as permitting and data records before designing a catch share instrument.

Sector allocations were also discussed as a management option for the pelagic fisheries, which include a mix of commercial, recreational, and subsistence activities. Sector level shares could be allocated based on history of participation even if there is insufficient information to assign catch shares to individuals or where doing so would contravene social mores. Verifiable historical records of individual catches are rarely available for recreational or subsistence fisheries and often little support for allocating individual shares to subsistence or recreational fishermen based on their previous participation is given. Catch share tools that have been used in similar circumstances include cooperatives, territorial use rights, and community development quotas (CDQs). A discussion of CDQ programs implemented in other communities, particularly those in western Alaska, followed.

Many workshop participants urged prompt consideration of additional management measures for the Hawaii longline tuna fishery because there is substantial latent capacity, and a race for fish is likely to ensue as soon as a total catch limit (quota) is imposed on the fishery or whenever the cap on turtle bycatch becomes binding.

> *Bigeye tuna was the first species in the Hawaii longline fishery subject to the international management measures of the Western and Central Pacific Fisheries Commission (WCPFC) in the western and Pacific Ocean and the Inter-American Tropical Tuna Commission (IATTC) in the eastern Pacific Ocean. The Hawaii fishery will be limited to 3763 mt of bigeye tuna annually in 2009, 2010 and 2011 under the WCPFC and is limited to 500 mt in 2009 by the IATTC. The WCPFC quota represents a 10% reduction in the Hawaii catch based upon a WCPFC specified historical baseline. Yellowfin tuna could be the species subjected to quota allocation on the horizon. The Hawaii longline pelagic fishery, particularly for bigeye tuna, was predicted as having a short term need for management reform after nearly reaching the quota during the peak season of demand (Christmas and New Year holidays) in 2009.*

Based on experience in other fisheries, a race for fish is a common outcome when TACs are imposed in the absence of a catch shares program. Furthermore, widespread experience suggests that efforts to control the race for fish are vain, given the endless opportunities for input substitution and the creative capacity of fishermen to adopt new technology and otherwise innovate to maximize their catch rates when faced with a binding annual TAC. Eliminating overcapacity and ending the race for fish have been common motivations for the adoption of current catch share programs. Individual vessels may impose contemporaneous (within season) or intertemporal (between season) externalities. Within a season, the race for fish causes contemporaneous externalities that affect the catch rates, bycatch rates, investment decisions, and profitability of other vessels. Intertemporal or stock externalities typically arise when the race for fish leads to overfishing that adversely affects stock productivity. Because the Hawaii longline fishery was one of the most mobile fisheries on earth and because it only catches a small percentage of the total number of bigeye caught in the North Pacific (EPO and WCPO), stock externalities are not a large concern in the management of WPFMC deepset (tuna targeting) longline fisheries management. However, there is concern that a race for fish within season could easily commence in this fishery. While this problem could be addressed through a one-time allocation of transferrable perennial catch shares, it could also be addressed with an annual form

of catch and bycatch shares. Most workshop participants agreed that a catch share program would be the best way to keep fishing within the TAC without causing a race for fish.

Considerable disagreement arose among workshop participants about the desirability and consequences of charging a resource rent on catch shares. It was noted that fishery resources belong to the nation as a whole and that resource rents are often charged for consumptive uses of other public resources, such as timber, oil, minerals, and grazing rights. Auctioning catch shares could generate payment to the public for harvests of a public resource but auctions could elevate the price of catch shares and exacerbate barriers for new entrants, which would result in the concentration of ownership.

Catch Share Options Related to Protected Species for the Pacific Islands Region

Because similar gear is used for shallow-set swordfish fishing and deep set tuna harvest, the species could be integrated in a single catch share program like the Alaska halibut and sablefish IFQ program. However, the question of integrating the two fisheries raised concerns over possible unintended consequences. If the species are treated as one allocation of shares, one fishery could shut down as a result of overfishing in the other. The question of caps on turtle takes in the swordfish fishery could also pose a threat to the tuna fishery; if the shares are multispecies there is concern that a maximized turtle cap from shallow-set fishing would shut down the deep set tuna fishery. On the other hand, if shares are species-based, the closure of the shallow-set swordfish fishery has potential to provoke fishermen to switch to deep set fishing for tuna given the use of similar equipment. Hawaii's previous closure of the shallow set longline fishery did lead to some transition into the tuna fishery, where fishermen became "generalists" in the longline industry rather than "specialists." Some discussion also arose regarding the coexistence and interaction of two management constraints: TACs and bycatch limits and the impact of catch share programs.

With the shallow set longline fisheries' current turtle TAC, an interesting discussion arose over catch share options for the fishery. It was not a question of allocating turtle takes, but rather how catch share instruments within the fishery would affect current bycatch caps. Some suggestions included varying the quota over a time period longer than 1 year, designing programs to incentivize "potentially killed turtles" on the market side, or pooling risk of turtle takes. A strong emphasis was placed on creating incentives for coordination or cooperation within the industry on the management of turtle bycatch. Industry pools can drive out the bad actors; the main objective for potential catch share tools in the shallow set fishery is to incentivize good behavior.

The Catch Share Workshop discussion provided a forum for the exchange of ideas pertaining to fishery management options in the Pacific Islands Region. Much dialogue surrounded the needs and wants of the region and possible solutions to changes on the horizon. Participants contributed elaborate accounts of experiences with catch share instruments in other regions. Participants urged the region to consider designing management techniques before an immediate crisis is faced, as status quo will not stay the same.

DISCUSSION AND RECOMMENDATIONS

Stinting access to and exploitation of scarce common pool resources is a challenge faced by every society since the dawn of civilization. The impetus to structure rules to control the harvest of marine fish and shellfish began with resources found in intertidal and nearshore zones where unfettered exploitation by unlimited persons could have grossly depleted the resource base. Over time, as technological innovation has rendered ever increasing numbers of fish and shellfish stocks accessible to exploitation, the fundamental question has not changed: how shall a society restrict access to and limit exploitation of common pool resources? Societies which have failed to solve this type of common pool dilemma have collapsed as a result of "inadvertently destroying the environmental resources on which their societies depended" (Diamond 2005).

Solution of the common pool resource dilemma is central to the design of institutions to support sustainable fisheries (NRC, 2002). NRC (1999a) suggests that sustainable fishing can be defined as:

> … fishing activities that do not cause or lead to undesirable changes in biological and economic productivity, biological diversity, or ecosystem structure and functioning from one human generation to the next; sustainable fishing does not lead to ecological changes that foreclose options for future generations.

The question of sustainable management of western Pacific fisheries involves biological, ecological, and social and economic dimensions. Each of these dimensions is dynamic and evolves through time along stationary or nonstationary trajectories.

Catch share programs can reinforce or supplant existing formal and informal resource sharing institutions (NRC, 1999b).

- Programs that reinforce status quo benefits attract more support and less opposition.
- Programs that scale initial allocations to the level of homogeneous groups are more likely to be adopted.
- There can be resistance to catch share programs that allow reallocation between sectors even when such reallocations are economically beneficial to individuals.

In considering adoption of a catch share program for any of the six candidate fisheries, one of the first considerations should be whether the catch share program can be designed to reinforce existing formal and informal institutions that foster responsible utilization of fishery resources (Schlager et al., 1994). Existing institutions may have a spatial dimension—I fish here, you fish there. Recognition of claims to customarily used areas served an important role in settling grazing rights in the western U.S. (Anderson and Hill, 1975; Dennen, 1976) and has been used in fisheries (see e.g., Wilen, above). Traditional catch sharing institutions could also include agreements to maintain minimum gear separation distances or to take turns setting gear on particularly productive grounds. These types of agreements could be formalized in local area management plans or TURFs. Fisheries are characterized by varying degrees of coordination and cooperation among fishermen. IFQs are more likely to be accepted in fisheries where cooperation has been limited; cooperatives are more likely to be accepted in fisheries where it is

traditional for groups of vessels to coordinate to share information or pool risk. Fisheries where participants share few common cultural or familial bonds are more likely to accept IFQs than they are to accept a shared allocation.

Stationary dynamics can affect the desirability and functionality of catch share programs.

- Widely fluctuating stocks create difficulties if infrastructure needed to fully exploit the stock during periods of peak abundance cannot be supported during periods of low productivity.
- Stocks with slow intrinsic growth in value can be difficult to rebuild from a financially or biologically overfished status.
- Catch shares can create barriers to target switching strategies that have been used by fishermen in regions with alternating ecological regimes.

Although the example of the multispecies groundfish IFQ in Canada (Turris and Dewees, above) and the newly implemented multispecies trawl IFQ in the Pacific Northwest (Sylvia, above) indicate that it is possible to design catch share programs for mixed stocks with varying levels of productivity, it is difficult to fully harvest dominant target species without exceeding quotas for rare species with low annual catch limits. Scaling the level of capital investment to the magnitude of widely fluctuating stocks is problematic—if capital is optimally scaled for periods of high abundance, there will be excess capacity in periods of low abundance. Historically, fishermen have had the ability to shift into and out of fisheries depending on stock abundance and market conditions. That flexibility could be lost under a catch share program. For example, when Bering Sea crab stocks crashed in the 1980s, crabbers were able to reconfigure to operate as catcher boats in the joint-venture and shorebased groundfish trawl sector. With catch shares in the crab and groundfish fisheries, switching is much less feasible. Indeed, because the vessels that qualify to participate in the pollock fishery are specifically named in the AFA and they are mostly prohibited from engaging in other fisheries, it is not possible for crab boats to surge into the pollock fishery or for pollock boats to surge into the crab fisheries. The loss of flexibility to move between fisheries is related to the presence of catch share programs, but there are so many specialist vessels in each fishery that little opportunity for generalist vessels to find undercapitalized fisheries even in the absence of catch share programs would be possible. While theoretical arguments have been advanced to suggest that catch share programs offer a conservation incentive, depleted stocks with low intrinsic growth rates will not be rebuilt without considerable effort and influence of fisheries managers.

Nonstationary dynamics can affect desirability and functionality of catch share programs. Changes in demand or the elasticity of demand can affect optimum yield and affect overall profitability of fished stocks. Although the Alaska salmon fisheries are not managed under a catch share program, they provide an illustrative example of the impact of a change in demand elasticity. In the mid-1980s, Alaska accounted for over 50% of world production of premium grade salmon. At present, Alaska accounts for less than 8% of world production. The change is not attributed to depletion of Alaskan stocks, but is instead a result of large increases in aquaculture production of premium grade salmon. Prices for Alaskan salmon are one-fifth of what they were in the 1980s. This price collapse devastated the salmon fishery. While a catch share program would have helped ameliorate the overcapitalization that accentuated the salmon crisis, it is unlikely that it would have completely buffered the salmon fishery from the

emergence of an effective competitor. There is growing interest in aquaculture of some of the species targeted in Pacific Islands Region fisheries. While it is unclear if these ventures will replicate the success of salmon aquaculture, if they do, they will act as a destabilizing influence on existing fisheries and fisheries governance structures. Changes in domestic legislation or international treaties can also disrupt fisheries. Creation of the Papahānaumokuākea Marine National Monument is an example of a fundamental change in ocean governance in the Northwestern Hawaiian Islands. In this example, whether the fisheries were or were not managed under a catch shares program would have made little difference. Changes in human populations and their demographics can also have fundamental effects that may vary depending on the structure of fishery governance institutions, including catch shares. For example, the anticipated increase in military personnel on Guam will affect local fisheries. Newcomers are unlikely to be aware of social norms and informal rules governing access to and utilization of fishery resources; traditional uses could be afforded greater protection if they were formalized as TURFs. Change in the mix of resource users is also potentially disruptive. For example, a charter fishery for halibut in southeast and south-central Alaska is growing. Under a traditional open access regime, growth of the charter sector would be accommodated by reductions in the commercial TAC. With IFQs in place, there is greater political will to set a firm allocation between the commercial and charter sectors. Because the magnitude of charter sector demand depends on tourism demand which is fickle, managers are considering a proposal that would allow charter operators to lease halibut annual quota from the commercial sector at the beginning of the tourism season and to release any residual back to the commercial sector at the end of the tourism season. Leasing will only take place if the incremental value of halibut to charter operators exceeds the incremental value of halibut to some commercial IFQ holder. Long-term changes in the productivity of fish stocks or the relative abundance of fish stocks is disruptive under any fishery management structure but may be particularly disruptive in a catch share program if the changes are unanticipated.

This workshop involved the participation of leading analysts of catch share programs. In considering the characteristics of Pacific Islands Region fisheries, they did not identify fisheries where catch shares are unambiguously needed. However, they concluded that it would be possible to design catch share programs suitable for some or all of the candidate fisheries if doing so would accomplish management objectives. The longline fisheries for swordfish and tuna were considered to be predisposed to collapse into fishing derbies driven by fear that turtle take limits or international tuna harvest quotas could close the fishery. It would be good to explore the feasibility and desirability of various types of individual or group catch and bycatch shares for that fishery. The MHI bottomfish fishery is another fishery that could easily see an unexpected surge of effort or bycatch concerns for one or more of the seven species that could trigger a race for fish. This is another fishery where it could be advantageous to consider a moratorium on entry and some form of cooperative catch share or sector allocation. Because it exists in such a small discrete location, the Cross Seamount fishery already faces congestion externalities that have engendered some autonomous coordination among fishers. This is a fishery where it could be useful to task fishers with proposing regulatory measures that would help formalize their current informal institutions. The large population influx to Guam is almost certain to generate resource conflicts. These could have been addressed before the influx began by formalizing social norms. While it is too late to entirely avert resource conflicts, it may be

possible to work cooperatively with the newcomers to establish formal rules that will minimize conflict.

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Appendix: List of Participants

Participant	Institution	Role
Stewart Allen	NMFS/PIFSC	Speaker
Kate Bonzon	Environmental Defense Fund	Speaker
Paul Callaghan	University of Guam	Speaker
Rick Chesler	NMFS/PIFSC	
Keith Criddle	University of Alaska Fairbanks	Speaker
Paul Dalzell	Western Pacific Fishery Management Council	Speaker
Kelly Davidson	NMFS/PIFSC	
Chris Dewees	University of California Davis	Speaker
Diane Dupont	Brock University	Speaker
Dan Holland	Gulf of Maine Marine Research Institute	Speaker
Justin Hospital	NMFS/PIFSC	
Walter Ikehara	NMFS/PIRO	Speaker
Alvin Katekaru	NMFS/PIRO	
John Lynham	University of Hawaii at Manoa	
Seth Macinko	University of Rhode Island	Speaker
Sarah Malloy	NMFS/PIFSC	
Bonnie McCay	Rutgers University	Speaker
Yu-ichiro Meguro	Hokkaido University	
Glenn Merrill	NMFS/AKR	Speaker
Sherrie Myers	NMFS Enforcement	Speaker
Minling Pan	NMFS/PIFSC	Speaker
Sam Pooley	NMFS/PIFSC	Speaker
Myles Raizin	NMFS/PIRO	
Alison Rieser	University of Hawaii at Manoa	
Craig Severance	NMFS/PIRO	Speaker
Gil Sylvia	Oregon State University	Speaker
Ralph Townsend	Winona State University	Speaker
Bruce Turris	Pacific Fisheries Management Incorporated	Speaker
Jim Wilen	University of California Davis	Speaker
Toby Wood	NMFS/PIRO	